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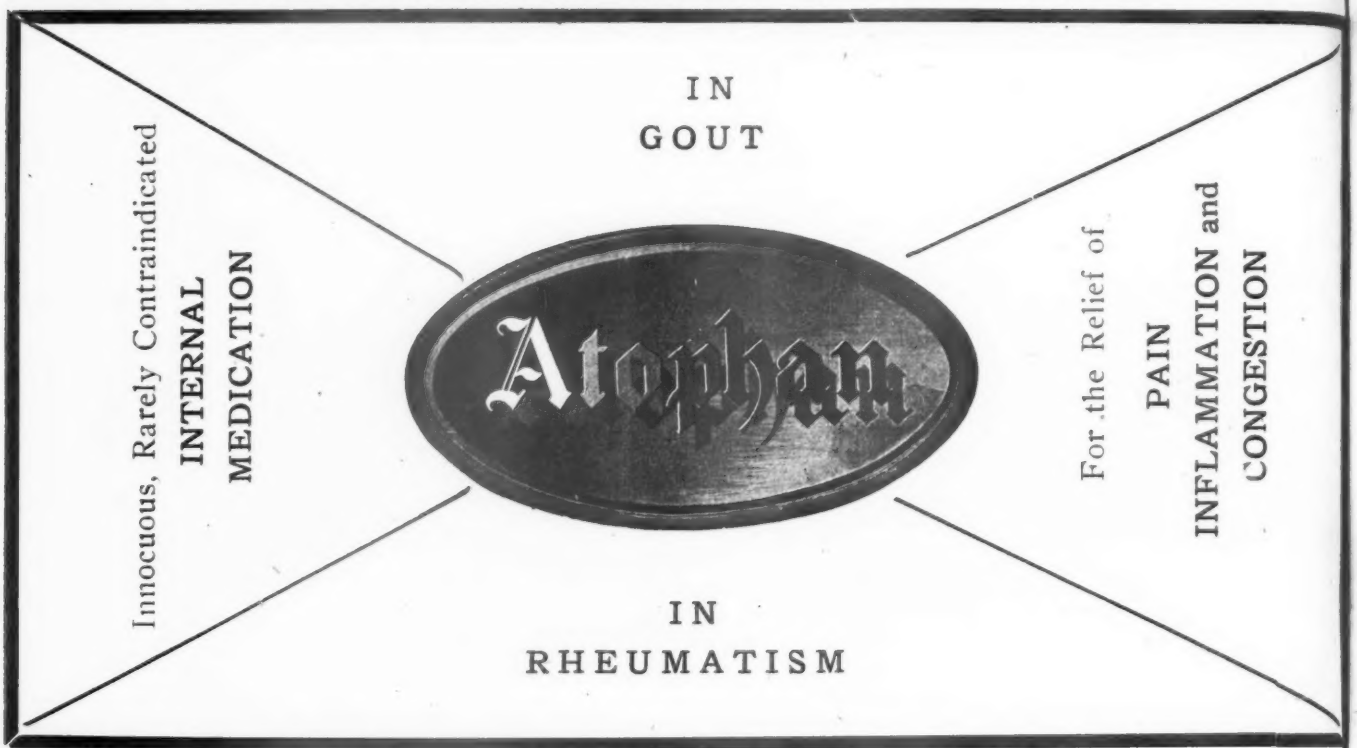

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GASEOUS EXCHANGE WITH UNPRACTICED SUBJECTS AND TWO RESPIRATION APPARATUS EMPLOYING THREE BREATHING APPLIANCES.

[From the Nutrition Laboratory of the Carnegie Institution of Washington, Boston, Mass.]

BY M. F. HENDRY, T. M. CARPENTER, AND L. E. EMMES, BOSTON.

THE increasing number of clinical studies of respiratory exchange necessitates the careful investigation of respiratory apparatus and breathing appliances recently developed. The apparatus probably most used at the present time is of the so-called Tissot type. A portable respiration apparatus which has lately been devised, primarily for the determination of the most important respiratory gas, *i.e.*, oxygen, has proved of special interest to clinicians. At least three breathing appliances have found extensive use, a mouthpiece, a nosepiece, and a half-face mask. The combinations possible with these two respiration apparatus and three breathing appliances need careful study to aid the experimenter in selecting the one best suited to his purpose. Such a comparative study has been made in this laboratory.*

Some of the questions investigated in this research may be stated as follows:

Do the two respiration apparatus give comparative values for the oxygen consumption of a subject?

What are the differences, if any, in the carbon-dioxide elimination and respiratory quotient?

If there are differences in these values, what are the technical and physiological causes for the variations as interpreted from the measurements of pulse rate, respiration rate, volume per minute of the respiratory ventilation, and composition of expired air?

The differences in the results obtained with the three breathing appliances were also measured for both apparatus. Concurrently information was obtained on several other matters of interest to users of apparatus for determining the respiratory exchange, *viz.*, the constancy of the level of the respiratory quotient during several hours of the post-absorptive state; the constancy of the total energy output (heat production) as measured by the oxygen consumption; and lastly (of prime importance to clinicians), whether measurements of the respiratory exchange with any of the combinations of apparatus are reliable when untrained subjects are used.

Arrangements were made through the kind-

* We desire to acknowledge the helpful advice and criticism of Professor Francis G. Benedict, at whose suggestion this investigation was made.

ness of Dr. Cecil K. Drinker of the Harvard Medical School for some of the first year medical students to act as subjects. While these young men were taking a course in physiology, they were in no way familiar, at that time, with respiration apparatus of any kind. Each subject came to the laboratory for the first time on the morning of the experiment.*

The respiratory apparatus and accessory apparatus used in this research are described in the following paragraphs.

PORTABLE RESPIRATION APPARATUS.

In the portable respiration apparatus recently developed in the Nutrition Laboratory, the oxygen absorbed by the subject is determined by measuring the contraction in volume of an enclosed circulating current of oxygen and nitrogen which a subject respires and from which both the water vapor and the carbon dioxide exhaled from the lungs are absorbed. This method gives a volumetric determination which is therefore subject to the ordinary corrections for reducing the value to 0° C. and 760 mm. pressure, and also requires the important assumption that the volume of air in the respiratory tract of the subject is the same (within experimental limits) at both the beginning and the end of the period.

The carbon dioxide elimination is determined by the absorption of this gas in soda lime. To determine the carbon-dioxide elimination by the method of absorption, it is necessary in a closed-circuit respiration apparatus that provision first be made for the absorption of water vapor. In this apparatus use is made of calcium chloride for the purpose. The determination of oxygen consumption, then, is volumetric and the determination of carbon-dioxide elimination gravimetric.

The principle of the Benedict portable respiration apparatus is practically the same as that of the original universal respiration apparatus[1] as employed for man. As with the older apparatus, the subject is connected with the circulating current of air by means of a three-way valve and a breathing appliance (mouthpiece, nosepieces, or mask.) The actual routine of the experiment is the same for the two apparatus but instead of using a blower in series with the absorbers as in the universal respiration apparatus, the air current in the portable respiration apparatus is actuated by a rotary air impeller (hair dryer) which is placed inside the spirometer. Thus leakage of air from the ventilating current is obviated, and the only leaks possible are such as may be due to poor mechanical construction or to imperfect connection of intermediate parts by unskilled operators. *These can be detected by a test for tightness preceding each experimental period.*

For the actual routine of a period with this apparatus, reference must be made to the original description,[2] which should be regarded as a handbook for operators. In brief, it may be stated that the subject is first connected with the apparatus by means of the breathing appliance selected. After the soda-lime container and the calcium-chloride container following it have been weighed, the three-way valve connecting the subject with the circulating air current is turned at the end of a normal expiration, the time is noted, and the subject respires for 10 to 15 minutes. At the end of a normal expiration the valve is again turned and the subject is disconnected. The spirometer is read both before the beginning of the period and after the end, the difference in the height of the spirometer bell showing the contraction in the volume of air due to the absorption of oxygen by the subject. The carbon-dioxide elimination may be determined by the increase in weight of the soda-lime bottle and the calcium-chloride container following it.

In this investigation, a graphic record of the respiratory ventilation was obtained by means of a pointer, attached to the counterpoise of the spirometer, which wrote upon the smoked surface of a moving kymograph drum. The manner of obtaining this record and its relationship to the respiration and the oxygen consumption of the subject have been fully discussed in a former publication from this laboratory.[3] To obtain a complete record of the respiration movements during a period, two drums of the Harvard Apparatus Co. kymograph were joined one above the other and a paper wide enough to cover them both was used. A special arbor was constructed to support the double drum, and the ordinary form of kymograph was employed.

The volume of a single respiration can be obtained by measuring the vertical distance

* There was one exception in that, as subsequently stated, H. O. was formerly an assistant in the Nutrition Laboratory.

between the beginning and end of a single phase of a respiration, either inspiration or expiration, and multiplying this distance by the value in cubic centimeters of one millimeter or one centimeter of the vertical cross section of the spirometer bell. The total apparent ventilation of the lungs during the experimental period is the sum of the individual respirations. Instead of measuring the respirations separately, their summation was obtained by scaling the individual vertical distances with a "map measurer." This map measurer has several scales on it, one of which is centimeters to kilometers. The sum of the vertical lengths was found to be in the neighborhood of 350 centimeters. Measurements of the total vertical distance in a single period, which were made independently by two persons, were found to agree, usually within two per cent. of each other. It was considered, therefore, that this method of measuring the summation of individual respirations met every requirement for accuracy in this research.* Accordingly, all of the values given for the periods obtained with the portable respiration apparatus are based upon measurements made by two individuals, independently, which agree within two to five per cent. In doubtful cases the summations were checked by the measurement of the individual respirations with a millimeter scale. The figures obtained with the map measurer were multiplied by the volumetric value of each millimeter (ca. 21 c.c.) and this result was then reduced to 0° C and 760 mm. pressure by suitable factors involving barometer, temperature, and tension of aqueous vapor. Special experiments were conducted to determine the temperature conditions prevailing in this measurement. So far as errors involved in barometic pressure, tension of aqueous vapor, and temperature are concerned, it is considered that any rôle they might play has no effect upon the conclusions drawn from the results.

The possibility of a mechanical or instrumental error should be considered. The pointer attached to the counterpoise of the spirometer consisted of a steel wire about 0.5 millimeters thick and 10 centimeters long, with a pointed piece of parchment paper attached to the free end. A moving pointer rubbing against a moving smoked surface involves a certain amount of friction, and it is conceivable that any record of a simple harmonic motion of a rigid body (such as the spirometer bell), which is dependent upon the inscription of its movements by means of a flexible pointer writing upon a surface involving friction, would be in error because of the lag at each end of the motion or change in direction. There are two facts to be considered in relation to the results of our research, *viz.*, that the movements of the air or the spirometer itself are slowest at the beginning and end of the two phases of the respiratory cycle, inspiration and expiration, and that if this possibility of error due to friction does play a rôle in the accuracy of our measurements of the total ventilation with the portable respiration apparatus, its effect will be to give too low results. The significance of the latter point will be seen when the data are discussed. In spite of the possibilities of technical errors, our belief is that no one of our measurements of the total ventilation with either apparatus has an error greater than five per cent. Our conclusions are not based upon such small differences.

Assuming a correct measurement of the total ventilation, it is possible with the portable respiration apparatus to calculate the composition of the expired air, so far as the percentage of the carbon-dioxide and the oxygen deficit are concerned, simply by dividing the carbon dioxide eliminated and the oxygen absorbed by the total ventilation. The volume per respiration can also be calculated from the total ventilation and the respiration rate.

The measurement of the total ventilation of the lungs as outlined and the data derived from it and from other observed factors form the basis of our results and conclusions given in this report.

RESPIRATORY-VALVE APPARATUS.

The other respiration apparatus used in this study was the so-called Tissot[4] respiration apparatus, or more properly the respiratory-valve apparatus.* The most recent forms of respiratory-valve apparatus ordinarily employ a

* The use of the map measurer was suggested to one of us (T. M. C.) by a former assistant, W. F. Barrington. It has proved very useful in the technical study of respiratory apparatus.

* The name Tissot has been incorrectly applied to a number of combinations of respiration apparatus that are not really the Tissot apparatus, which involves glass nosepieces, valves, an ingeniously water-balanced spirometer, and a Laulanié gas analysis apparatus.

mask† as a breathing appliance. Usually the Thiry-Tissot valves[6] are also employed, but that other valves are equally suitable for this purpose has never for a moment been questioned or denied. It is not necessary that the spirometer be absolutely counterpoised[7] at each point to obtain a normal respiratory exchange. Actual experience shows that the portable Haldane gas analysis apparatus is entirely adequate for all analyses of expired air and that any irregularities of analysis will apply as much to other gas analysis apparatus as to the portable form of the Haldane apparatus. In view of these considerations we can no longer consent to designate every open-circuit apparatus based upon breathing appliance, respiratory valves, spirometer, and gas analysis as a Tissot respiration apparatus. We acknowledge our indebtedness to Tissot for pointing out the possibilities of refinement in the measurement of gaseous exchange by this method, but we must state that accurate determinations by the open-circuit method of the respiratory exchange of man are regularly made without utilizing any of the apparatus which were devised by Tissot.

The combination used in this comparison research was a spirometer approximately counterpoised and holding about 100 liters, Thiry-Tissot valves, a breathing appliance, and a Haldane portable gas analysis apparatus. The breathing appliances used were the same as those employed with the portable apparatus.

The principle of the respiratory-valve apparatus is as follows: The subject inhales through an inspiratory valve and breathing appliance and expires through an expiratory valve. The inspired air and expired air are thus separated by means of valves. The inspired air may be taken from the room or from outdoors. We prefer to use outdoor air because of its constant composition,[8] thus reducing the amount of gas analysis. The expired air is conducted to a spirometer in which it is collected for a definite period of time. A three-way valve placed at the entrance tube of the spirometer permits deflection of the expired air into the room or into the spirometer.

In the usual routine of a period with this method, the breathing appliance with valves is first attached to the subject, and the spirometer is set at 0. When it is seen that the subject is breathing quietly and regularly, the three-way valve is turned so that the expired air, which has been passing out into the room, now enters the spirometer. The exact time of turning the valve is noted. At the end of a definite period (usually ten minutes) the three-way valve is turned so that the expired air is again delivered into the room. The time is noted, and readings are taken of the height of the spirometer bell, the temperature of the air in the bell, and the barometric pressure. Two samples of the air in the spirometer are then drawn in 70 c.c. samplers over mercury and subsequently analyzed. One portion from each sampler was used for analysis, thus providing for duplicate analyses. All analyses not agreeing within reasonable limits were repeated. The composition of these samples, multiplied by the quantity of expired air reduced to 0° C. and 760 mm., gave the amount of the respiratory exchange.

BREATHING APPLIANCES.

The breathing appliances used in this comparison were the Denayrouse form of rubber mouthpiece,[9] the Benedict nosepieces,[10] and the Siebe-Gorman half-face mask.* The mouthpiece was of the type employed for many years in respiration work, particularly by Zuntz and his co-workers. A detailed description and criticisms regarding its use have been given in a publication from this laboratory.[11] The half-face mask employed was originally designed for mine rescue apparatus, but is now coming into general use in physiological laboratories and hospitals in which respiratory exchange is being studied. It is approximately triangular in form and is made of sheet metal covered with vulcanized rubber. It is thus flexible so that it can be readily shaped to fit the face of the subject. A pneumatic gasket around the edge of the mask can be inflated, thus making it possible to fit the inequalities of various parts of the face and insure an absolute air-tight closure. The mask is of such size and form that it fits over the upper part of the bridge of the nose, down each cheek, and across the chin just beneath the mouth. It is fastened on the face by means of two straps connecting at the back part of the head.

† Experience in this laboratory in 1915-1916 demonstrated that the mask was most suitable for continuous or interrupted work on respiratory exchange so far as breathing appliance was concerned.

* This may be obtained from H. N. Elmer, 1140 Monadnock Building, Chicago, Ill.

GAS ANALYSIS APPARATUS.

The samples of expired air were analyzed by means of the portable form of the Haldane gas analysis apparatus.[12] Two apparatus were employed in this research, each controlled daily by an analysis of outdoor air collected in the identical containers used for drawing samples from the spirometer. The values obtained in these analyses of outdoor air were for carbon dioxide from 0.02 to 0.03 per cent., and for oxygen from 20.91 to 20.94 per cent., with an average of 20.93 per cent. A solution of 10 per cent. caustic soda was used for the absorption of the carbon dioxide; potassium pyrogallate made up according to the directions of Haldane[13] was employed for the absorption of oxygen. All of the determinations were carried out by one analyst (M.F.H.).

ACCESSORY APPARATUS.

The accessory apparatus were principally those required for control purposes and consisted of pneumographs, a kymograph, recording tambours, signal magnet, push buttons, and a time clock.

Apparatus for Time Record. A clock was used which was so arranged that it would close an electric circuit every half minute. Connection with a signal magnet gave a record upon the kymograph drum of the closing of the circuit. The clock was also in series with a push button by means of which the operator could record upon the kymograph the exact beginning and end of the period. This record acted as a control upon the total length of the period as obtained with a stopwatch. This control is to be recommended as it sometimes happens that either the split-second watch stops or there is a mistake made in recording the time.

Apparatus for Recording Respiration Rate and Degree of Repose. A pneumograph was placed around the thorax of the subject to provide a graphic record of the respiration rate. Movements of the upper portion of the body were also shown in this record. A second pneumograph was placed about the upper thighs so that the slightest movement of the legs would be recorded upon the kymograph drum. These two pneumographs enabled us to detect immediately any movements which the subject might make and to determine the degree of repose.

Apparatus for Detecting Sleep. In addition to the records of activity or repose, we also used a control upon drowsiness or sleep. This was obtained by means of a signal magnet placed near the subject's head and in series with the clock previously mentioned. The magnet operated every half minute and was heard by the subject if he were awake. He was instructed to press a push button held in his hand whenever he heard the signal magnet. As the subject's push button was connected with an independent signal magnet recording upon the kymograph drum, a definite graphic record was obtained as to whether or not the subject responded the entire experimental period. *This is very important in studies of the respiratory exchange, as our experience has been that drowsiness tends to alter the ratio between the carbon dioxide eliminated and oxygen consumed. Whether or not there is also a real difference in the character of the combustion cannot at this time be stated.*

PLAN OF STUDY AND SEQUENCE OF PERIODS.

We had the problem of determining the respiratory exchange of a subject each day with two different respiration apparatus and three different breathing appliances. To avoid any influence from one order of combinations for all subjects, the following six sequences of periods were used:*

I	II	III
Tissot, mouth	Portable, mouth	Tissot, mask
Portable, mouth	Tissot, mouth	Portable, mask
Tissot, mask	Portable, mask	Tissot, nose
Portable, mask	Tissot, mask	Portable, nose
Portable, nose	Portable, nose	Tissot, mouth
Tissot, nose	Tissot, nose	Portable, mouth
IV	**V**	**VI**
Portable, mask	Tissot, nose	Portable, nose
Tissot, mask	Portable, nose	Tissot, nose
Portable, nose	Tissot, mouth	Portable, mouth
Tissot, nose	Portable, mouth	Tissot, mouth
Portable, mouth	Tissot, mask	Portable, mask
Tissot, mouth	Portable, mask	Tissot, mask

It was our original intention to study three subjects with each sequence and to duplicate the order, thus making twelve periods each morning. Such a plan would involve the use of 18 subjects. Unfortunately, the omission of a routine test on the part of one of us vitiated one of the sequences. The actual experiments with each are as follows:

I. 3 experiments II. 3 experiments III. 3 experiments
IV. 4 experiments V. 2 experiments VI. 2 experiments

* In this list the word "Tissot" is used instead of "respiratory-valve" for brevity.

EXPERIMENTAL ROUTINE.

The subject came to the laboratory at about 8 A.M., in the post-absorptive condition. He then emptied the bladder, if this had not been done very shortly before arrival. After the object of the experiment and the precautions to be observed had been briefly described to him, the mask was fitted to his face, and tested for tightness. The subject usually removed coat, collar, and cravat and lay down on a comfortable upholstered couch. A stethoscope was attached to the chest over the apex of the heart and fastened by means of adhesive plaster. A Y-tube was next inserted for use with two sets of earpieces so that two observers could count the pulse auricularly and thus act as a control upon each other. After the stethoscope had been adjusted, two pneumographs were attached and tested. To avoid the use of subjects in a febrile condition, the body temperature was taken sublingually with a clinical thermometer retained for five minutes.

After the mouth temperature had been taken, the pulse rate of the subject lying quietly was recorded by one or more volunteer student observers, and in the later experiments a graphic record of the normal respiration rate was obtained from the pneumograph placed around the thorax. At the end of approximately a half hour from the time the man actually lay down on the couch, the first period for the determination of the respiratory exchange was begun. Twelve periods were then carried out as rapidly as possible according to the order determined for the morning. After their completion, the subject again emptied his bladder, had his height and naked body weight measured, and then answered a number of questions with regard to his subjective impressions, personal history, age, etc.

STATISTICS OF SUBJECTS.

To show the character of our subjects and for comparison with other published material, the statistical data are given in table I. The first column contains the initials in the order used in the table giving the average results (table II). The second column gives the age in the year nearest to the actual time of the experiment; the third column, the height in centimeters; the fourth column, the naked body weight at the end of the experiment and after urinating; the last two columns give the nitrogen in urine calculated on the basis of per hour and per kilogram per hour.

TABLE I. STATISTICS OF SUBJECTS IN THE COMPARISON RESPIRATORY EXCHANGE EXPERIMENTS.

SUBJECT	AGE	HEIGHT	NAKED BODY WT.	NITROGEN IN URINE	
				Per Hour	Per Kgm. per Hour
	yrs.	cms.	kgms.	gms.	mgms.
J. A. C.	25	177	59.6	.537	9.08
C. A. C.	22	180	64.9	.585	9.00
H. H. H.	22	173	71.5	.577	8.07
T. H. N.	24	190	69.1	.380	5.50
J. F. T.	22	188	63.8	.073	—
A. G. N.	24	172	59.9	.562	9.36
J. L. G.	21	163	65.5	.460	7.02
F. S.	24	172	57.4	.304	5.30
W. F. M.	24	181	76.1	.425	5.58
S. N. G.	23	178	60.8	.408	6.72
W. J. S.	23	172	56.5	.350	6.19
C. S. B.	24	174	61.4	.408	6.64
H. O.	23	172	67.2	.870	12.95
P. G. H.	22	176	52.1	.508	9.75
C. F. M.	23	161	51.1	.204	3.99
R. K. B.	22	179	65.8	.447	6.80
H. B.	25	166	64.6	.429	6.65

It will be seen that our subjects ranged in age from 21 to 25 years, in height from 161 to 190 centimeters, and in weight from 51.1 to 76.1 kilograms. Consequently, we have a good range in both height and weight, but the data show no definite correlation between these two factors. Personal impression and acquaintance lead us to say that T. H. N. was very tall and rather lean, that C. F. M. was quite short but not extraordinarily thickset, and that H. H. H. impressed us as being somewhat heavily built. The nitrogen in the urine per hour varied from 0.073 gram with J. F. T. to 0.870 gram with H. O. We have carefully inspected the data obtained for J. F. T. and have concluded that in his case there must have been retention of urine; consequently, the real range begins at the lowest with C. F. M. with a value of 0.204 gram. The nitrogen per kilogram per hour ranged from 3.99 milligrams with C. F. M. to 12.95 milligrams with H. O. Our subjects, therefore, show somewhat wide ranges in all characteristics except age.

METHOD OF PRESENTING AND DISCUSSING RESULTS.

The general method of presenting and discussing results is as follows:

A summary is given in table II for each of the 17 subjects, showing the average results obtained with the two respiration apparatus: the protocols of the most nearly uniform and of the most divergent set of results with individual subjects are also tabulated (see table

III). The averages of all measurements and the detailed results as illustrated by the two special examples are discussed.

The averages of all results with each breathing appliance are grouped in table IV.

The averages of the first and second measurements with each breathing appliance and respiration apparatus, together with the averages of the individual differences, are likewise considered.

The general features of the results, their correlations and their significance, are presented.

The problems concurrently investigated, *viz.*, the relation of the respiratory quotient and the oxygen consumption to the period of the day, and the necessity for the training of subjects, are considered; finally, recommendations as to use of respiration apparatus, breathing appliances, controls, and number of periods are given.

COMPARISON OF RESULTS FOR THE TWO RESPIRATION APPARATUS.

The averages for all the results obtained with each respiration apparatus and with each subject are given in table II. The data for R. K. B. and H. O. are given in detail in table III as examples of the best and the poorest sets of results from the standpoint of uniformity and agreement of duplicates with the various breathing appliances and respiration apparatus. The measurements which were made, and the results calculated to the per minute basis and according to the relationship of the various factors, were as follows: Carbon-dioxide elimination, oxygen consumption, respiratory quotient, average pulse rate, average respiration rate, volume of respiratory ventilation, volume per respiration, and percentage composition of expired air, *i.e.*, carbon-dioxide content and oxygen deficit.

The average carbon-dioxide elimination of all subjects with the respiratory-valve apparatus was 190 c.c. as compared with 202 c.c. with the portable apparatus, with a difference of 12 c.c., which can be regarded as a true difference. The detailed data for the two subjects, R. K. B. and H. O., show that the average carbon-dioxide elimination for R. K. B. with the respiratory-valve apparatus was 195 c.c. and with the portable apparatus 199 c.c., an excellent agreement. With H. O., on the contrary, the average was 197 c.c. for the respiratory-valve apparatus and 204 c.c. for the portable apparatus, a positive difference of 7 c.c.

The average oxygen consumption with the respiratory-valve apparatus was 233 c.c. and with the portable apparatus 238 c.c., a remarkably good agreement. This agreement is corroborated by the detailed data for R. K. B. and H. O. The average oxygen consumption with R. K. B. for both the respiratory-valve apparatus and the portable apparatus was 245 c.c. With H. O. it was 230 c.c. with the respiratory-valve apparatus and 233 c.c. with the portable apparatus.

The average respiratory quotient for all of the subjects was 0.82 with the respiratory-valve apparatus and 0.85 for the portable apparatus. Considering again the two special subjects, we find that with R. K. B. the respiratory-valve apparatus gave 0.80 and the portable apparatus 0.82. With H. O. the quotients averaged 0.85 and 0.88. These differences of 0.02 and 0.03 for the two apparatus with the two subjects agree with the differences between the averages for all of the subjects.

The average pulse rate with the respiratory-valve apparatus for all of the subjects was 65 and with the portable apparatus 63—a slight but, perhaps, significant difference. With R. K. B. the average pulse-rate for the respiratory-valve apparatus was 68 and for the portable apparatus 66, while with H. O. the pulse rate for the two apparatus was 70 and 65. In other words, not only the average of all subjects but also the two special examples show that the higher pulse rate was obtained with the respiratory-valve apparatus.

The average respiratory rate with all subjects was 14.2 with the respiratory-valve apparatus and 14.5 with the portable apparatus—a difference without significance. With the subjects R. K. B. and H. O. the differences are 0.1 and 0.9, also without significance so far as respiration rates are concerned.

The average ventilation volume per minute with the respiratory-valve apparatus for all subjects was 5.26 liters as compared with 6.47 liters for the portable apparatus. With R. K. B. the volume was 4.60 liters with the respiratory-valve apparatus and 5.27 liters with the portable apparatus. With H. O. it was 5.73 liters, and 6.28 liters with the two apparatus. It is thus seen that the difference in the volume of the respiratory ven-

TABLE II. SUMMARY OF MEASUREMENTS OF THE RESPIRATORY EXCHANGE WITH 17 UNTRAINED SUBJECTS, USING THE PORTABLE APPARATUS AND A RESPIRATORY-VALVE APPARATUS.

(Values per minute.)

SUBJECT, DATE, AND APPARATUS	CARBON DIOXIDE	OXYGEN	RESPIRATORY QUOTIENT	AVERAGE PULSE RATE	AVERAGE RESPIRATION RATE	VOLUME PER MINUTE	VOLUME PER RESPIRATION	EXPIRED AIR	
								CARBON DIOXIDE	OXYGEN DEFICIT
1918	c.c.	c.c.				liters	c.c.	%	%
J. A. C., April 8									
Respiratory-valve	184	244	.76	67	15.5	5.71	438	3.26	4.25
Portable	216	248	.87	66	14.5	7.16	603	3.06	3.51
C. A. C., April 9									
Respiratory-valve	187	237	.79	56	17.8	6.18	419	3.06	3.83
Portable	211	245	.86	56	17.6	7.58	518	2.84	3.28
H. H. H., April 10									
Respiratory-valve	212	255	.83	54	15.5	5.70	440	3.76	4.50
Portable	227	257	.89	53	17.2	7.37	510	3.24	3.54
T. H. N., April 11									
Respiratory-valve	213	266	.80	60	12.1	5.88	592	3.71	4.60
Portable	220	278	.82	58	14.9	7.32	588	3.18	3.86
J. F. T., April 12									
Respiratory-valve	209	253	.83	67	13.5	5.53	496	3.91	4.61
Portable	217	247	.84	63	14.6	6.65	552	3.32	3.89
A. G. N., April 15									
Respiratory-valve	188	231	.82	73	11.6	5.18	549	3.68	4.49
Portable	217	242	.90	73	11.1	6.67	759	3.33	3.74
J. L. G., April 16									
Respiratory-valve	185	228	.81	67	15.5	5.10	400	3.68	4.49
Portable	198	228	.87	65	15.7	6.70	519	3.00	3.43
F. S., April 17									
Respiratory-valve	173	216	.80	66	15.4	4.76	380	3.66	4.56
Portable	170	219	.78	62	16.5	6.06	450	2.87	3.70
W. F. M., April 18									
Respiratory-valve	218	264	.83	62	14.8	6.15	505	3.58	4.29
Portable	219	268	.84	62	15.5	8.49	668	2.68	3.20
S. N. G., April 23									
Respiratory-valve	205	260	.79	75	13.7	5.28	472	3.92	4.93
Portable	198	270	.73	73	15.6	7.71	600	2.74	3.72
W. J. S., April 25									
Respiratory-valve	152	193	.79	57	17.0	4.77	346	3.23	4.05
Portable	174	202	.86	57	15.7	5.49	421	3.25	3.78
C. S. B., April 26									
Respiratory-valve	185	236	.79	72	11.4	4.83	536	3.98	4.89
Portable	222	225	1.00	73	10.5	5.92	685	3.77	3.82
H. O., April 30									
Respiratory-valve	197	230	.85	70	15.4	5.73	452	3.49	4.12
Portable	204	233	.88	65	16.3	6.28	471	3.28	3.75
P. G. H., May 1									
Respiratory-valve	196	219	.89	65	10.2	5.01	608	3.96	4.42
Portable	184	216	.85	62	9.1	4.90	666	3.77	4.49
C. F. M., May 2									
Respiratory-valve	149	181	.82	56	16.1	4.34	326	3.48	4.18
Portable	156	188	.83	54	15.1	4.89	389	3.25	4.04
R. K. B., May 3									
Respiratory-valve	195	245	.80	68	9.7	4.60	579	4.29	5.35
Portable	199	245	.82	66	9.8	5.27	653	3.80	4.56
H. B., May 6									
Respiratory-valve	177	213	.83	73	15.9	4.68	356	3.88	4.63
Portable	190	216	.88	71	16.1	5.54	419	3.49	3.96
Average with Respiratory-valve	*190*	*233*	*.82*	*65*	*14.2*	*5.26*	*464*	*3.67*	*4.48*
Average with Portable	*202*	*238*	*.85*	*63*	*14.5*	*6.47*	*556*	*3.22*	*3.77*

tilation per minute varied in the same direction, and approximately to the same degree not only with the averages for the whole group of 17 subjects but also with the two subjects who have been selected as illustrating either the greatest range of variation or the best set of results. All of the figures compared show a lower total ventilation of the lungs with the respiratory-valve apparatus than with the portable respiration apparatus.

The volume per respiration for the average of all subjects was 464 c.c. with the respiratory-valve apparatus and 556 c.c. with the portable apparatus. With R. K. B. it was 579 c.c. with

TABLE III. PROTOCOLS OF MEASUREMENTS OF RESPIRATORY EXCHANGE WITH SIX COMBINATIONS OF RESPIRATION APPARATUS AND BREATHING APPLIANCES. SUBJECTS R. K. B. AND H. O.

(Values per minute.)

SUBJECT, DATE, APPARATUS, AND TIME.	CARBON DIOXIDE	OXYGEN	RESPIRATORY QUOTIENT	AVERAGE PULSE RATE	AVERAGE RESPIRATION RATE	VOLUME PER MINUTE	VOLUME PER RESPIRATION	EXPIRED AIR: CARBON DIOXIDE	EXPIRED AIR: OXYGEN DEFICIT
1918	c.c.	c.c.				liters	c.c.	%	%
R. K. B., MAY 3									
Respiratory valve									
Mask									
8.51 a.m.	199	247	.80	71	9.7	5.09	634	3.93	4.86
10.38 a.m.	181	234	.77	67	9.3	4.43	578	4.11	5.29
Nosepieces									
9.29 a.m.	198	248	.80	71	9.9	4.20	514	4.73	5.91
11.18 a.m.	197	244	.81	66	9.9	4.31	529	4.60	5.66
Mouthpiece									
10.03 a.m.	197	244	.81	69	9.0	4.71	635	4.21	5.19
11.52 a.m.	200	251	.80	65	10.1	4.86	584	4.15	5.17
Average	*195*	*245*	*.80*	*68*	*9.7*	*4.60*	*579*	*4.29*	*5.35*
Portable									
Mask									
9.09 a.m.	194	245	.79	69	9.4	5.55	716	3.50	4.41
10.55 a.m.	185	239	.77	67	9.1	5.40	719	3.43	4.43
Nosepieces									
9.46 a.m.	194	241	.81	66	9.9	4.82	590	4.02	4.42
11.34 a.m.	203	240	.85	62	10.2	4.90	582	4.14	4.90
Mouthpiece									
10.18 a.m.	201	241	.84	67	10.2	5.10	606	3.95	4.73
12.07 a.m.	219	261	.84	66	10.1	5.85	703	3.74	4.46
Average	*199*	*245*	*.82*	*66*	*9.8*	*5.27*	*653*	*3.80*	*4.56*
H. O., APRIL 30									
Respiratory valve									
Mask									
9.16 a.m.	171	225	.76	67	16.7	5.71	416	3.02	3.94
11.02 a.m.	155	230	.67	66	12.1	4.76	479	3.28	4.83
Nosepieces									
9.54 a.m.	190	222	.86	70	14.2	4.87	418	3.94	4.56
11.39 a.m.	179	215	.83	70	14.3	4.69	400	3.86	4.59
Mouthpiece									
8.40 a.m.	248	255	.97	74	18.0	7.29	493	3.44	3.50
10.28 a.m.	237	231	1.03	71	17.1	7.07	504	3.39	3.27
Average	*197*	*230*	*.85*	*70*	*15.4*	*5.73*	*452*	*3.49*	*4.12*
Portable									
Mask									
9.33 a.m.	175	228	.75	64	16.0	6.41	489	2.78	3.56
11.20 a.m.	180	235	.77	64	16.4	6.62	492	2.72	3.55
Nosepieces									
10.11 a.m.	185	237	.78	64	15.5	5.17	407	3.58	4.58
11.56 a.m.	232	226	1.03	65	16.1	6.13	464	3.79	3.69
Mouthpiece									
8.54 a.m.	230	238	.97	69	17.4	6.18	432	3.72	3.85
10.42 a.m.	222	235	.95	65	16.2	7.17	540	3.10	3.28
Average	*204*	*233*	*.88*	*65*	*16.3*	*6.28*	*471*	*3.28*	*3.75*

the respiratory-valve apparatus and 653 c.c. with the portable apparatus, and with H. O., 452 c.c. and 471 c.c. The direction of the differences with the two subjects is the same as with the average of all subjects, but the amount of variance is not so great with H. O. as with R. K. B.

The percentage of carbon-dioxide in the expired air for the average of all subjects with the respiratory-valve apparatus was 3.67 per cent. and with the portable apparatus 3.22 per cent. This is a small but positive difference. With R. K. B. the percentage carbon-dioxide content was 4.29 and 3.80 per cent. for the two apparatus and with H. O. it was 3.49 and 3.28 per cent. The difference between the portable and respiratory-valve apparatus with the two special subjects is in the same direction and of about the same order of magnitude as the difference with the average of all subjects.

The average oxygen deficit of the expired air for the whole group with the respiratory-valve apparatus was 4.48 per cent. and with the portable apparatus 3.77 per cent. This difference is more marked than that for the carbon dioxide in the expired air. With R. K. B. the de-

ficit was 5.35 and 4.56 per cent. with the two apparatus and with H. O. it was 4.12 and 3.75 per cent. The direction of the difference is thus exactly the same with the two subjects, and with each there is an indication that the variation between the apparatus is greater with the oxygen than with the carbon dioxide.

With R. K. B. the agreement both as to apparatus and also as to the agreement of two successive periods with the same apparatus and breathing appliance is all that could be desired or expected in work with respiratory-exchange apparatus. It shows the possibilities with a subject who is coöperative and is not apprehensive or influenced by the conditions of the experiment in any way. It also shows that fundamentally there is no great difference so far as the character of the respiration apparatus or the breathing appliance is concerned. The factors of ventilation and composition of expired air given for R. K. B. in the last four columns of table III show distinct differences between the two apparatus on the average and these differences agree with the differences in the averages for all of the subjects. Consequently, we have to conclude that these variations are significant. Since the data in the last four columns indicate in all their relations that the ventilation with the portable apparatus and the respiratory-valve apparatus is not the same, a physiological factor is implied.

When we compare the results for R. K. B. obtained with the three breathing appliances, we find no great difference with either the portable apparatus or the respiratory-valve apparatus. The highest oxygen consumption was obtained with the mouthpiece, the next highest with the nosepieces, and the lowest values with the mask, the order in the values being the same for both respiration apparatus. The respiratory quotient followed the same general course, but the differences with the three breathing appliances are less with the respiratory-valve apparatus than with the portable apparatus. The significant fact regarding the pulse rate is that the lower results were always obtained in the second period with a breathing appliance with either apparatus as compared to those for the first period. The differences in the last four columns of the table which were apparent when the respiratory apparatus alone were considered, are also evident when the results are compared for the various breathing appliances as used with the two apparatus.

The second subject included in table III (H. O.) illustrated the difficulty in obtaining good agreement in the measurements of all the physiological indices employed in our research. He was formerly a laboratory assistant in the Nutrition Laboratory and consequently should have had no apprehension regarding the experiment and, indeed, should have been more or less familiar with the experimental conditions and with what would be expected of him as a subject. His coöperation was absolutely satisfactory. The agreement in the results for the two respiratory apparatus was fairly good for the physiological indices. But when we consider the ranges in the values for both the apparatus and the three breathing appliances, it is evident that we have here a subject who cannot be depended upon to give a satisfactory agreement of figures in all of the measurements and calculated results possible with the technique employed in our research.

When two periods with the same breathing appliance are compared, the agreement in the values for the oxygen consumption is as good in general with H. O. as with any other subject, and there is but little choice as to breathing appliance or respiration apparatus so far as the measurement of the oxygen consumption is concerned. This fact confirms the conclusion already gained in a previous comparison of respiration apparatus, *i.e.*, that the oxygen consumption can be obtained with a fair degree of accuracy with any standard apparatus employing breathing appliances.[14]

From the standpoint of the measurement of either carbon-dioxide production or respiratory quotient, H. O. is hopeless as a subject. The results obtained with him bring out clearly the difficulties which are likely to occur when one attempts to determine the respiratory quotient or the carbon-dioxide elimination in short periods with a respiration apparatus employing breathing appliances. In other words, H. O. has a respiratory center which is exceedingly sensitive to mechanical or physiological obstruction in normal respiration. The two respiratory quotients with any breathing appliance and respiration apparatus which most nearly approach his average are those obtained with the nosepieces and respiratory-valve apparatus. But even in these two periods there are sev-

eral inconsistencies in the measurements.—namely, the values for the carbon-dioxide elimination and the oxygen absorption are among the lowest values obtained for these factors and the pulse rate is high in comparison with the other periods. H. O. would certainly not be our first choice in selecting a subject for an exact scientific research in which measurements of changes in the amount and character of the total metabolism were involved; but he represents a type which one is quite likely to meet in clinical work, and therefore his results are of importance in showing the possible difficulty in drawing definite conclusions from one day's measurements.

The conclusions from both the averages of all the subjects with the two types of apparatus and from the detailed results of the two subjects, R. K. B. and H. O., are that the measurements of oxygen consumption agree very closely so far as any requirements regarding the measurements of basal metabolism are concerned, that the carbon-dioxide elimination is higher with the portable apparatus than with the respiratory-valve apparatus, and in consequence, the respiratory quotient is higher with the portable apparatus than with the respiratory-valve apparatus. Lastly, that all of the coincident measurements in this research, namely, the ventilation per minute, the volume per respiration, and the composition of expired air, confirm the average results for the carbon-dioxide elimination and the respiratory quotient.

COMPARISON OF RESULTS FOR THE THREE BREATHING APPLIANCES.

The averages of all results obtained with the three breathing appliances (nosepieces, mouthpiece, and mask) are given in table IV. In comparing these values, it should be borne in mind that man ordinarily breathes through the nose and that when he breathes through the mouth, it is because of habit, of demand (as in exercise), or of mechanical or pathological obstructions in the nose. The breathing appliance most suitable for meeting all these conditions is the mask.

The carbon-dioxide elimination with the three breathing appliances is highest with the mouthpiece (201 c.c.) and lowest with the mask (191 c.c.).

The average values for the oxygen consumption range from 235 c.c. for the nosepieces and mask to 238 c.c. for the mouthpiece, an extremely small range.

The respiratory quotient is highest with the mouthpiece (0.85) and lowest with the mask (0.81). The average results with the mouthpiece and nosepieces agree very closely, but those for the mask show a significant difference.

The pulse rates vary but little, the average values for the three breathing appliances ranging from 64 to 65.

The respiration rate is lowest with the nosepieces, with a slight difference between this average value and those obtained with the mouthpiece and mask, the two latter averages varying but little from each other.

The respiratory ventilation per minute is lowest with the nosepieces (5.40 liters) and highest with the mask (6.36 liters). The value for the mouthpiece corresponds to practically an average of the other two. So far as the volume per minute is concerned, there is really no significant difference with the three breathing appliances which cannot be explained either by results of previous research[15] or by the effectual dead space of the breathing appliance involved.

The volume per respiration and the composition of expired air show values which, in their differences, are fairly consistent with the measurements previously considered.

This comparison of values obtained with the

TABLE IV. AVERAGES OF ALL MEASUREMENTS MADE WITH THE NOSEPIECES, MOUTHPIECE, AND MASK.

(Values per minute.)

Breathing Appliance	Carbon Dioxide	Oxygen	Respiratory Quotient	Pulse Rate	Respiration Rate	Volume per Minute	Volume per Respiration	Expired Air: Carbon Dioxide	Expired Air: Oxygen Deficit
	c.c.	c.c.				liters	c.c.	%	%
Nosepieces	196	235	.84	64	13.8	5.40	494	3.72	4.41
Mouthpiece	201	238	.85	64	14.5	5.83	503	3.52	4.17
Mask	191	235	.81	65	14.7	6.36	534	3.10	3.80

three breathing appliances therefore indicates that all of the appliances give concordant values for oxygen consumption and that the mask gives the lowest values for carbon-dioxide elimination and respiratory quotient.

(To be continued.)

THE RECONSTRUCTION OF A GERMAN SHELL SHATTERED ARM. THE REPORT OF AN HISTORICALLY IMPORTANT CASE.

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FROM an historical as well as a surgical point of view, it seems well to record the cases of John Zitz and John Bogovich, two members of the crew of the tug "Perth Amboy" attacked by a German submarine off Orleans, Cape Cod, on July 22, 1918.

From an historical standpoint these cases are interesting because, as far as can be ascertained, these men, both wounded by German shells, were the first and only American casualties of the war for whom all treatment, from first aid station to base hospital, was administered by the United States. Also this attack was the only bit of the European war to be seen from American shores and during it, the only German shell of the war landed on American soil.

From a surgical standpoint they are important because Bogovich presents an unusual case of bone transplantation and also an excellent example of a septic wound treated by the Carrel-Dakin method.

At 10.15 on the morning of July 22, 1918, a bright, clear day, the tug "Perth Amboy," towing four barges partly laden with stone, was fired upon by a German submarine. From the shore, the submarine was plainly visible about three miles out with the tug and tows one mile closer in. The first shell fell short of the tug, the next two far over it, but the fourth struck the pilot house where Zitz and Bogovich were stationed. Then followed about fifty shells, the submarine firing in rotation from a gun mounted on deck at the tug and the tows. By this time the U-boat was close onto the other vessels and every shot was a hit. From the shore, there could be seen a blaze of fire followed immediately by a cloud of smoke as a shell burst against one vessel or another. Twenty-five minutes after the first shell was fired, a seaplane appeared from the Chatham Naval Station, seven miles away; but just before it reached the submarine, the latter submerged, with its aerial masts still visible, however, giving its exact location to the aviator. He dropped a depth bomb which did not explode, circled once, and started back to his station. As he did so, the submarine again came to the surface and fired at him. This shell the aviator heard pass by him and it was this shell that landed in a small pond about one mile inland, the first German shell to land in this country.

Two of the tows had by this time gone down, and the submarine began again its interrupted work on the tug and the other two barges. Altogether the bombardment lasted between forty-five and fifty minutes, the submarine riding practically all of that time on the surface of the water. With a third barge sunk, the fourth sinking, and the tug in flames, it submerged and was not seen again. It was indeed an amazing and exasperating spectacle to those of us who were watching from the shore, just two miles away.

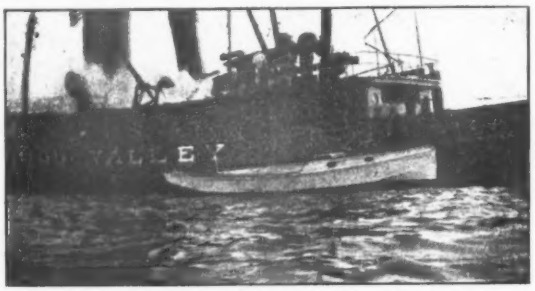


FIG. 1.—The tug *Perth Amboy*.

Zitz and Bogovich were brought to shore by the other members of the crew, being carried from the tug after the first shell had struck them. Zitz had a small shell wound on the outer side of his right knee but was otherwise in good condition.

Bogovich, on the other hand, in a moderate degree of shock, had a shell wound over the lateral border of his left scapula with the fragfent definitely palpable just beneath the skin. His right upper arm was badly crushed with two deep jagged wounds just above the elbow.

The wounds were hastily washed at the Orleans Life Saving Station, sterile dressings applied, and the arm immobilized. Both men

were taken to the Massachusetts General Hospital. X-rays of Bogovich's arm and shoulder were taken which showed the shell fragment in the shoulder and the shattered condition of the right humerus.

FIG. 2.—Shell fragment in left shoulder, which was removed.

Bogovich was immediately anaesthetized and the shell fragment, about a three-quarter inch cube, removed from the back. The skin margins of the wounds around the right elbow were cut away, devitalized muscle and tissue removed, and many fragments of shell and bone were taken out. There was a fracture running between the condyles of the humerus, which extended into the joint. The condyles were pulled together with a ligature of kangaroo tendon, leaving a distal stump of the humerus of about one and one-half inches. The wounds were irrigated with quantities of sterile salt solution, followed by Dakin's solution, and four Carrel tubes were then inserted. The wound was treated by the routine Carrel-Dakin method of a daily dressing under aseptic precautions and bi-hourly instillations of Dakin's solution. Prints below show the patient at the time he was undergoing this treatment with the special Dakin carriage beside him.

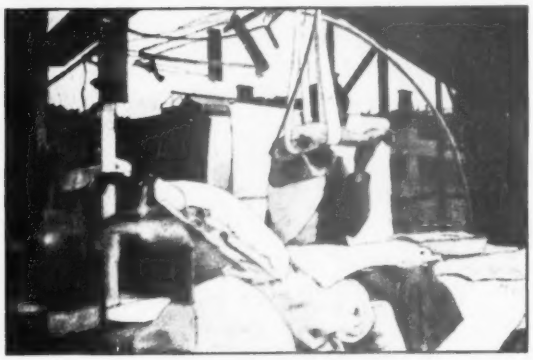
At first the wounds discharged considerable pus which cleared up rapidly under the treatment, the tubes being removed one by one as the different parts of the wounds became free

FIG. 3.—Humerus before operation.

of bacteria. The last tube was removed on August 28th, five and a half weeks after their introduction.

On October 16th, with the granulations completely covered with skin and all wounds entirely healed, Bogovich was sent from the hospital to rest for three months. His arm was at the time protected by a leather splint and a sling. The arm without the splint in position was flail because of the loss of bony substance from the lower end of the humerus.

He returned on January 25th of this year and was operated on a week later by one of us. The ends of the old fractured humerus were freed from the surrounding tissue and curetted. The medulla of the humeral shaft was opened and the distal fragment was prepared for the reception of the graft. The left fibula was exposed and six inches resected with periosteum attached. After the ends of the graft were shaped, and while maintaining traction on the arm to lengthen the gap of five inches between the ends of the bone, the graft was driven into



FIGS. 4 and 5.—Bogovich during the period of Carrel-Dakin irrigation.

the medulla of the proximal end of the humerus and made to engage in the cavity prepared in the distal end. On letting up on the traction, the graft was firmly fixed. The wound was closed in two layers and the arm put up in plaster, superimposed on an internal right angular splint. The X-ray print below shows the arm a few days after this operation; the upper end of the humerus indistinctly shows at the top of the print.

By overhead apparatus, the humerus was suspended at a right angle to the body and kept in this position about six weeks. X-rays taken from time to time showed the graft to be in good condition.

At the end of that time, the cast and splints were removed, stitches were taken out and another cast applied. This cast still held the forearm flexed to 90 degrees and the shoulder joint was immobilized by a plaster spica with the humerus now in its normal position. On May 3rd, the spica was removed, giving free play at the shoulder, and a simple plaster shell and sling applied to immobilize and support the elbow.

The graft was united solidly with the ends of the humerus. X-Ray shows the periosteum growing from the two ends of the humeral fragments. The patient already has about ten degrees of motion in the elbow joint. He has been receiving massage twice a week since May 1st. The size of the fibula fragment has increased as it has assumed its new function and everything points now to a strong joint with slight motion.

The case serves to illustrate the value of delay in performing a plastic bone operation until the initial sepsis has been entirely eliminated and until several weeks have elapsed to insure that

FIG. 6.—Immediately after operation.

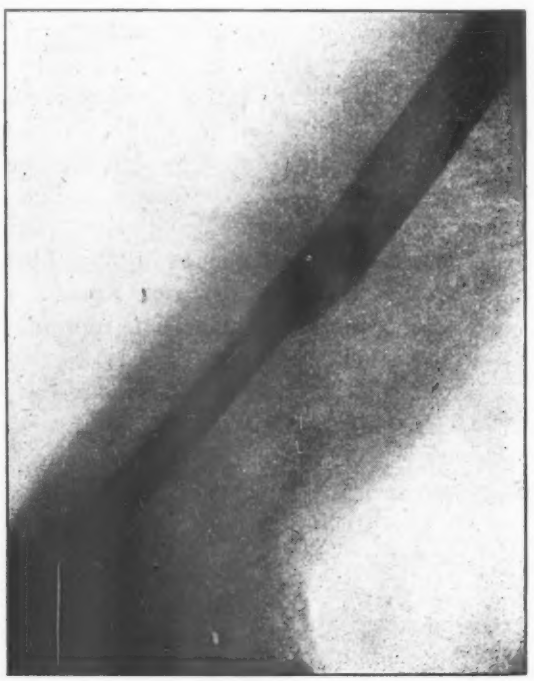


FIG. 7.—Some weeks after operation.

FIG. 8.—Latest x-ray of graft. Note security of ends of graft.

no recurrence of the infection will take place when the plastic operation is done.

In this case three months were allowed to pass before the bone plastic was done.

KANSAS UNIVERSITY MEDICAL SCHOOL.—The sum of $200,000 was appropriated recently for the building for the Kansas University Medical School, which will be erected provided the City of Rosedale furnishes the additional ground needed, which is valued at $60,000.

A GRAPHIC METHOD FOR RECORDING CONJUGATE DEVIATION TESTS, AND ITS USE, ILLUSTRATED BY A CASE RECORD.

BY EDWARD A. TRACY, M.D., BOSTON.

This brief paper serves two purposes. It illustrates a graphic method (the writer's) of recording the condition found when testing for conjugate deviation of the eyes, and it publishes a bit of research work upon which is based the finding that conjugate deviation when found in epilepsy is not a constant, *i.e.*, unchangeable condition.

The writer heard Bárány state, in 1914, that the normal positions of the eyes when closed are (1) looking upward, (2) diverging, (3) converging; if both eyes look to the left or to the right, the positions are respectively conjugate deviation to the left and conjugate deviation to the right, and are abnormal. Bárány also stated that conjugate deviation is due to an increase of supra-nuclear tonus, and that the centres for motion of the eyes are in the cerebral cortex.

The writer, following Bárány's instruction, tests for conjugate deviation by having the patient look at him, and then telling him to close the eyes and keep them closed, not too firmly, while the writer with his thumbs gently but firmly pushes up the patient's upper eyelids, thus disclosing the position of the eyes. The positions in which the eyes are found are denoted by the following symbols:

‖ denotes that the eyes look upward (normal)

\ / denotes that the eyes diverge (normal)

/ \ denotes that the eyes converge (normal)

// denotes that both eyes look to the *patient's* left, hence conjugate deviation to the left (abnormal)

\\ denotes that both eyes look to the *patient's* right, hence conjugate deviation to the right (abnormal)

Each line of the symbols represents the line of motion the eye (or rather the cornea) travels from its position at the lower end of the line (with the eyes open) to its position at the upper end of the line, the latter being the position in which the eye is found on gently forcing upwards the upper lid in making the test. An advantage of the graphic method of representing the conditions found is that it permits of the speedy recording of conditions, evidently abnormal, yet not specifically so designated here-

tofore. For example, the symbol |/ denotes that the right eye was found to look upwards and the left eye to look to the left, a condition not accurately described as divergence, since the left eye did not diverge in its line of motion, but kept straight upward.

The following record in which these symbols are used to denote the positions of the eyes as found in testing for conjugate deviation, is taken from notes of observations made in a case of idiopathic epilepsy. The patient, H. D., is aged 17 years. The record includes observations made between August 15, 1916, and December 5, 1916. The interesting feature of these observations is that they record graphically the change of a conjugate deviation to the left to a normal position of divergence, the change occurring quite gradually after a preliminary sudden change on October 14, 1916. There appears to have been a period of vacillation between October 15 and December 5 (1916), when the condition of divergence became established, insofar as the condition of divergence has remained the same up to the present time, June 28, 1919.

Record of the conjugate deviation tests made in case of H. D.:

Aug. 5, 1916,		6.00 P.M.	Eyes	//	(Conjugate deviation to left)
Aug. 31,	"	10.30 A.M.	"	//	
Sept. 3,	"	12.00 M.	"	//	
Sept. 13,	"	11.00 A.M.	"	//	
Sept. 23,	"	11.45 A.M.	"	//	
Sept. 24,	"	12.45 A.M.	"	//	
Sept. 25,	"	12.30 P.M.	"	//	
Sept. 26,	"	12.00 M.	"	//	
Sept. 29,	"	10.00 A.M.	"	//	
Oct. 2,	"	7.00 P.M.	"	//	
Oct. 4,	"	7.00 P.M.	"	//	
Oct. 7,	"	1.00 P.M.	"	//	
Oct. 8,	"	11.30 A.M.	"	//	
Oct. 10,	"	7.30 P.M.	"	//	
Oct. 11,	"	2.00 P.M.	"	//	
Oct. 12,	"	2.00 P.M.	"	//	
Oct. 14,	"	9.15 A.M.	"	\/	(Divergence)
Oct. 15,	"	7.00 P.M.	"	//	
Oct. 16,	"	7.30 P.M.	"	//	(Eyes to left, right eye less so than left)
Oct. 17,	"	12.30 P.M.	"	//	
		7.00 P.M.	"	//	
Oct. 18,	"	7.00 P.M.	"	//	
Oct. 19,	"	1.00 P.M.	"	//	
Oct. 20,	"	9.00 A.M.	"	\/	(Divergence)
		7.00 P.M.	"	//	
Oct. 21,	"	10.30 A.M.	"	\/	
Oct. 22,	"	10.30 A.M.	"	\/	
Oct. 23, 1916,		9.00 A.M.	Eyes	\/	
		7.00 P.M.	"	\/	
Oct. 24,	"	7.00 P.M.	"	\/	

(The eyes diverged similarly till November 26, when the left eye diverged less strongly than the right, as is shown by the symbol.)

Nov. 26, 1916,		9.00 A.M.	Eyes	\/	(Divergence)
Nov. 28,	"	9.00 A.M.	"	\/	(Divergence)
		7.30 P.M.	"	|	(Left eye looks upward)
Dec. 3,	"	8.45 A.M.	"	|	(Left eye looks upward)
Dec. 4,	"	9.00 A.M.	"	|	(Left eye looks upward)
		7.00 P.M.	"	\/	(Divergence)
Dec. 5,	"	8.45 A.M.	"	|	(Left eye looks upward)
		7.00 P.M.	"	\/	(Divergence)

RESULT OF THE EXAMINATION OF THE PROSTATE AND VESICLES IN 125 CASES WITH NEGATIVE VENEREAL HISTORY.

BY GEORGE GILBERT SMITH, M.D., BOSTON,
AND
HENRY N. KLEIN, 1ST. LIEUT., M. C., U. S. A.

[From U.S.A. General Hospital No. 9, Lakewood, N. J.]

AT General Hospital Number 9, Lakewood, N. J., cases of arthritis were examined by the Urological Service to determine whether or not a focus of infection existed in the genito-urinary tract. It occurred to the writers that the result of the examination of the prostate and seminal vesicles in this group of patients might be of some interest as establishing the frequency with which evidences of infection may exist in the genitalia of those men who have never had gonorrhea.

Of the patients whose examinations are recorded, 107 were men between the ages of 20 and 30; 15 were between 30 and 35, and three were older than 35. In this study, age seemed of no importance. The men were questioned carefully as to the possibility of a past infection. Of the 388 men examined, there were only 150 who denied venereal disease. This fact, reinforced by our own impressions of the honesty of the men, leads us to the opinion that the truth was told in all but perhaps a very few instances.

ROUTINE OF EXAMINATION.

The external genitalia were examined for the presence of discharge and for abnormality of the scrotal contents. The urine was inspected

for turbidity or shreds. Palpation of the prostate and vesicles was done with the bladder empty. The secretion expressed by massage was caught on a slide, dried, fixed in the flame, stained with Loeffler's methylene blue and examined under the oil immersion lens. The number of polymorphonuclear leucocytes in 10 fields was counted and the average number per field determined. In doing this it was our endeavor to select areas where the secretion was thickest, so that the figures might not underestimate the facts.

RESULTS OF EXAMINATION.

Of the 125 cases with negative venereal history comprising our series, prostatic massage produced no secretion at all in 18. In 72, the secretion expressed showed no pus at all. In 10 cases, the count showed an average of 2 leucocytes or less per field. These cases we have arbitrarily considered as not showing sufficient evidence of infection to be called examples of "prostatitis." Thirteen cases gave a count of more than two leucocytes per field. Their records follow:

No. of Cases	Average Number Leucocytes per Oil Immersion Field
5	12.0
7	6.1
30	2.3
41	10.8
57	8.0
69	9.0
71	4.0
77	Too numerous to count
81	8.0
82	"Large amount of pus"
84	3.0
106	5.0
120	4.0

We believe that these cases may be said to have prostatitis or vesiculitis. In none of them was the examiner able to say, on the evidence of palpation, whether the prostate or the seminal vesicles were chiefly concerned. Throughout the study, we were impressed by the unreliability of the information gained by palpation alone. Many cases who proved to have no pus in the secretion had hard prostates or distinctly palpable vesicles. Others, whose secretion contained much pus, had soft prostates and vesicles which certainly did not feel indurated. It is perfectly possible that the cases with indurated vesicles or sclerosed prostates, but with no pus in the secretion, have at some time had an infection, and that this infection has died out, leaving scar tissue.

Five cases gave a history of orchitis of mumps. We have not included these among the preceding cases.

CASE 2. Age 29. Mumps affecting the left testicle, 1 year ago. Venereal disease denied. Has had arthritis, which is now cured. External genitalia normal. Urine clear. Prostate soft, secretion easily expressed. Vesicles not distinguishable. Secretion shows pus cells per oil immersion field as follows: 28, 19, 33, 31, 47.

CASE 60. Age 27. Complaint—Pain in back. Mumps involving left testis in February, 1918 (one year ago). Testis was swollen for 2 months. Denies venereal disease. Examination shows no atrophy of testicle. Prostate and vesicles not remarkable. Secretion: 3 leucocytes in 10 fields.

CASE 114. Age 26. Rheumatism for past two months. Venereal disease denied. Mumps when 15 years of age. He thinks that both testes were affected slightly. Examination: Right testis soft and half the size of the left. Prostate small. Vesicles hard and sharply outlined, especially the right one. Secretion: some spermatozoa. One leucocyte in 10 fields.

CASE 116. Age 20. Arthritis. Venereal disease denied. Had left orchitis of mumps, in childhood. Right testis normal, left one is small and half the size of the right testicle. Prostate and vesicles small and soft. No pus in the secretion.

CASE 121. Age 24. Arthritis. No venereal history. Left orchitis due to mumps one month ago. No abnormality of left testis now. Urine slightly turbid. Prostate and vesicles rather hard on palpation. Secretion: No pus cells.

Of these 5 cases of orchitis due to mumps, 2 showed atrophy of the testicle. In case 121, the orchitis was too recent for atrophy to have resulted. One case (case 2) exhibited pus in the secretion from prostate and vesicles. Induration of prostate and vesicles in two other cases (114 and 121) was suggestive of an inflammatory process in the past. The thought suggests itself that orchitis of mumps may sometimes be a factor in the causation of a non-gonococcus infection of the vesicles.

There were some half dozen cases presenting features worthy of special mention.

CASE 62. Age 24. Complaint, pain in legs. Denies venereal disease. Says that he has had

his prostate massaged a number of times "because the notion took him." Examination shows that the prostate contains a number of indurated areas. The vesicles are palpable. The secretion, small in amount, consists of chunks of pus and epithelium. The case is evidently one of low grade infection of prostate and vesicles, cause unknown.

CASE 88. Negative save for the presence in the secretion of one clump of pus cells containing about 20 leucocytes.

CASE 99. Negative save for the the presence in the secretion of one clump of pus cells containing about 100 leucocytes.

These two cases are quoted simply as a matter of record, as no deductions can be drawn from them.

CASE 89. Age 23. Arthritis. Venereal disease denied. No history of orchitis. Left testicle only half the size of the right; it appears to be atrophied. Urine clear. Right vesicle plastered onto the pelvic wall. Secretion: 20 pus cells in 10 fields. The findings in this case point to a chronic infectious process, etiology unknown.

CASE 93. Age 29. Prostate and vesicles hard, suggesting an old inflammatory process. Secretion: spermatozoa. No pus.

CASE 110. Right vesicle plastered onto pelvic wall. No pus in the secretion.

CASE 117. Vesicles feel like cords. No secretion expressed.

The last three cases (93, 110 and 117), characterized by induration of the vesicles without pus in the secretion, probably owe this condition to infection, now a matter of past history, which has burnt itself out.

If we include all the cases noted in our records as having had no venereal disease, we find that 16 cases out of 125 showed more than 2 pus cells per oil immersion field and might therefore be said to have prostatitis or vesiculitis. Cases with indurated vesicles but with no pus in the secretion are not included. In this series of 125 cases, therefore, about 13% of the men who had no venereal disease, showed definite signs of a prostatitis or vesiculitis. In practically all of these, there were no symptoms referable to the prostatic condition, nor did it seem, in any of these cases, as if their arthritis was due to infection from this source.

American Medical Biographies.

CABOT, ARTHUR TRACY (1852-1912).

Arthur Tracy Cabot was born in Boston January 25, 1852, third son of Dr. Samuel (*q. v.*) and Hannah Jackson Cabot. The families of which his parents were members were and are deservedly prominent. Strict integrity characterized them both, but in many qualities they widely diverged. The Perkins-Cabot is sporting blood. The Jacksons are far from being devoid of enterprise, but perhaps their most salient mark is a sense of duty combined with clear intelligence. Arthur Tracy Cabot's great grandfather, Thomas H. Perkins, was second to none of his day as a merchant. No active port was a stranger to his ships, though he gradually concentrated on the China and India trade. In one of his letters early in 1800 he says in substance: "There is great risk in our business, but it would not be so interesting if there were not."

Cabot had a sub-twist ancestry, Scotch, Irish, English, Norman, French (Chabot, Isle of Jersey) blood mingling in his veins. In him the contrasted qualities of his parents were harmoniously united to a remarkable degree. Ardent and impulsive, he was yet rationally cautious. He valued the opinion of others and weighed it, but reached his own conclusions, which were nearly always sound, and then fearlessly followed. If he was or seemed prejudiced, the cause was apt to lie in his hatred of injustice and moral obliquity. No form of apparent self-interest ever swayed his decision.

He took his A. B. at Harvard in 1872, his M. D. in 1876, and served a year as surgical interne at the Massachusetts General Hospital. He then went abroad, giving special attention to surgical pathology, but neglecting no opportunity of laying a firm foundation in all pertaining to the healing art.

So many sided was his life that clearness and justice alike seemed to warrant separate treatment of the man, the surgeon, and the public servant.

Of Arthur Cabot, the man, I have already spoken somewhat. It remains to add that it is hard to think of a manly outdoor sport which he did not enjoy and enter into as far as he could without neglect of duty. Exercise in the saddle, riding to hounds, polo, fishing and shoot-

* From the forthcoming "American Medical Biography," by Dr. Howard A. Kelly and Dr. Walter L. Burrage. Any important additions or corrections will be welcomed by the authors.

ing, yachting, golf, tennis, and squash. Of art he had a deep love and appreciation, collecting a few very choice pictures without the aid of experts, so-called. He sketched in water colors, was an active trustee of the Boston Museum of Fine Arts, and officially concerned with the Fogg Art Museum at Cambridge. His diversified interests, elevation of character, and real warmth of heart made him more and more sought after socially. A certain grimness of manner wore smooth in later life, unless stimulated by contact with what he deemed unworthy.

Cabot's training for professional life antedates the general adoption of Listerism, *i. e.*, clean surgery, an outgrowth of the work of the great Pasteur. His interest in surgical pathology has been mentioned. After his father's death, he and his brother, Samuel, founded at the Massachusetts General Hospital the Samuel Cabot Fund for Pathological Research. The income of this fund provided that a pathologist be on hand on operating days at the hospital, and make such examination as the surgeon may require to determine the scope and character of his operation. If not the first, it was surely an early effort to make thorough pathological study go hand in hand with the operation. In London he heard Lister's inaugural address at King's College, and ever after kept on the crest of the advancing wave of clean surgery. On his return in 1877, he took up general practice. The experience thus gained can be safely said to have harmed him neither as a man nor as a surgeon. Without this developmental training it may be well questioned whether he would have been able to perform the great public service of his later years, of which more below.

Increasing surgical work at the Carney, Children's, and Massachusetts General Hospitals successively compelled him, after about ten years, to confine himself to surgery. He was visiting surgeon at the Massachusetts General Hospital from 1886 to 1907. Dr. Henry J. Bigelow early recognized Cabot's quality and made him his heir in bladder surgery.

It appears that Cabot did the first successful abdominal operation within the Massachusetts General Hospital in 1884 on a case of strangulated umbilical hernia. He had assisted his father in 1874 and 1875 in two abdominal operations on hospital patients, though not within the hospital walls. He became the leading genito-urinary surgeon in New England, while second to none anywhere. He always remained a general surgeon. As a general surgeon he was eminent; as a genito-urinary surgeon, pre-eminent.

From 1885 to 1896 he was clinical instructor, and then instructor in genito-urinary surgery in the Harvard Medical School, and would undoubtedly have gone to the top on his merits had he not been chosen Fellow of the University in 1896. The President and Fellows of Harvard, generally known as the Corporation, are seven in number, including the President and Treasurer *ex officiis*. They may be roughly compared to the United States Senate; the Overseers, elected by the Alumni for six year terms, being the House. All important academic questions need concurrent action by the two governing boards, but the management of the funds rests entirely, and much of the initiative lies, in the hands of the Corporation. The varied interests and the responsibility involved, the wisdom and devotion required go without saying. He was president of the Massachusetts Medical Society in 1905 and 1906, and did much to excite the active interest and participation of the profession in the crusade against tuberculosis. He was appointed in 1907, by Governor Guild, a trustee of the State Hospitals for Consumptives, was elected chairman, and threw himself heart and soul into the work. Three hospitals were admirably built and equipped in wisely selected sites, within the appropriation, at a cost of about seven hundred dollars a bed. His interest was enlisted in school hygiene. He was associated in the Congress for School Hygiene in London in 1907, was a prime mover in the organization of the American School Hygiene Association in 1908, and in the holding of the fourth Congress in Buffalo in 1913, serving as Chairman of the Executive Committee of Arrangements. His modesty was on a par with his efficiency and devotion. In 1910 he retired from all practice that he might give himself up to wider activities. During thirty years he published over one hundred and twenty papers, the last, in the *Atlantic Monthly* for November, 1912, a plea for the prevention and treatment of tuberculosis in childhood. He was a prized member of many medical societies and of the American Academy of Arts and Sciences. This is a meagre account of the life of one foremost as a man, a surgeon, a citizen. In each capacity *totus, teres atque rotundus*. A rarely balanced youth was trained professionally before scientific progress had made it nigh inconceiv-

able that an active surgeon should lay aside his knife for the kind and quality of work to which Cabot's last years were devoted. He died November 4, 1912, leaving a widow, Susan, daughter of the late George O. Shattuck, and a memory, sweet to his friends, stamped on a grateful community.

FREDERICK C. SHATTUCK, M.D.

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Book Reviews.

Nerve Control and How to Gain It. By H. ADDINGTON BRUCE. New York and London: Funk & Wagnalls Company. 1918.

In response to numerous requests for the publication in book form of a series of daily talks by Mr. Bruce which appeared in the Associated Newspapers, this volume has been arranged in some fifty odd chapters, in each one of which a certain phase of the subject of nerve control is discussed. In a very informal way the subject is presented and is not tiresome nor too technical reading for those who may need the assistance of such a book. It is the author's intention that this be simply a series of helpful suggestions which may be followed in every-day life by persons who are not nervous as well as by those who are the victims of "nerves." The book has been designed only to be of incidental assistance and does not presume to discourage reliance on expert medical advice. Helpful suggestions concerning food, exercise, habits, worry, timidity, the value of a right outlook, the value of fresh air as a curative, exercise for nerve control, causes of fatigue, mental gymnastics, habits that hurt, etc., are among the many practical discussions. The book should prove helpful to many.

The Child's Unconscious Mind. By WILFRED LAY. New York: Dodd, Mead and Company. 1919.

By describing the elements of the unconscious mind and explaining its effects on the life of the individual and his adaptation to his environment, the author of "The Child's Unconscious Mind" hopes to give parents and educators insight into the complexes of the human organism and to enable them more intelligently to guide the mental activities and development of children. The relations between the child, his school work, the teacher, and the parent are of vital concern. The author of this book believes that present day education fails to recognize the importance of the unconscious mental life, and offers reasons to show that it is through this channel that those who are entrusted with the care of children can most powerfully influence them and best assist them in adapting themselves happily to their surroundings. He describes the attitude of the child toward work, and illustrates it by examples of the constant satisfaction of unconscious wishes. Psychoanalysis, whether practised by the physician or by the educator, aims to alter the physical environment, to amplify consciousness, to remove unconscious fear, and to sublimate the unconscious desires. How this can be accomplished is illustrated by many examples of the working of the unconscious mind and its effects upon the life and development of the individual. This presentation of the subject will be of interest to all who have any responsibility in the bringing up of children.

Tuberculosis of the Lymphatic System. By WALTER BRADFORD METCALF, M.D. New York: The Macmillan Company. 1919.

The possibility that glandular tuberculosis appearing in childhood may be the cause of adult pulmonary tuberculosis is becoming recognized by the profession. This volume, "Tuberculosis of the Lymphatic System," emphasizes the importance of this view and urges early and proper prophylactic methods of prevention. The book presents an anatomical résumé of the most important glandular chains and areas of lymphatic drainage of the head and neck. Physiological considerations, including the composition, circulation, and the formation of lymph, and the function of the lymphatic vessels and the lymph glands are discussed. Several varieties of tubercle bacilli, including the humanus, bovis, avium, and piscium types of bacillus tuberculosis are considered; and other factors bearing upon the etiology of the disease, such as general and hereditary predisposition to the disease, previous diseases, and the influence of environment, age, and site are explained. In a discussion of the relation between scrofulosis and tuberculosis, the author comments upon the views of Cornet, Virchow, Escherich, Czerny, Heubner, Salge, Hochsinger, Saltman, and Eustace Smith.

The pathology of the disease, with a discussion of various modes of infection, is considered, and the symptomatology, prognosis, and diagnosis of tuberculosis of the lymphatic system are discussed. X-Ray therapy, surgical treatment, and heliotherapy are considered; but perhaps the most valuable contribution which this book makes in the treatment of tuberculosis is the section dealing with tuberculin. The reasons for the apparent failure in the past of tuberculin in the treatment of tuberculosis are considered, and those conditions are contrasted with modern methods of administrating tuberculin and the results obtained through its use.

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THE DECLINING BIRTH-RATE IN GREAT BRITAIN.

IN recent issues of the JOURNAL we have commented upon the declining birth-rate in England. *The Medical Press* has likewise pointed out the gravity of the British situation. An article recently published in that journal seeks to arouse the British public, as it has been awakened to the perils of venereal diseases, to a recognition of the facts and their significance. The menace from venereal diseases has been arrested by an outspoken declaration of things which have hitherto been spoken in whispers. In the meantime, the steadily declining birth-rate has been noticed with scarcely more than comment.

The statistics just issued by the Registrar-General have shown, for the first time in the history of these returns, a death-rate which has exceeded the birth-rate; and this is true in spite of the fact that the decreasing death-rate has indicated an improvement in the national health. Nor can this be explained through neglect of motherhood and child welfare. The truth must be recognized: that the conscious limitation of families to small proportions has become the rule. At first introduced by the wealthy classes because of social and other duties, this custom has spread to the middle and lower classes, mainly through economic reasons. In some cases, the parental instinct is subordinate to the desire for freedom to indulge in pleasures; young boys and girls are sent to boarding schools in order that their parents may be relieved of the responsibility of caring for them. It is a regrettable fact that the children of working people are deemed an encumbrance by the employers, and young children are often excluded by landlords from homes and lodgings. It has been observed that the casualty lists have shown how often the son has been the only one in the family.

In order to emphasize the sinister aspect of the declining birth-rate with reference to war, attention is called to the fact that in France, with a total area of 207,016 square miles, there was, in 1911, a population of 39,601,509; while in Germany, with an area of 208,780 square miles, there was, in 1910, a total population of 64,925,993, of whom 32,071,967 were males. Had France fought Germany alone, her inferior numbers would have been to her decided disadvantage. These figures should arouse the British nation to a consideration of the probable outcome at the end of a half century if its birth-rate continues to decline.

MEDICAL AND SURGICAL CARE OF INDUSTRIAL WORKERS.

AN investigation of one hundred and seventy industrial establishments in the East and Middle Western States, for the purpose of determining the medical and surgical facilities for the care of workers, has been reported in Public Health Bulletin No. 99. The personnel, equipment, activities, methods, and record forms necessary to the care and relief of sick and injured industrial workers and the prevention of sickness have been observed.

The value of medical service to industry is measured principally by its effects on production, and consequently, its power to prevent sickness and undue loss of time from injuries.

In order to accomplish this, one of the first requisites is a safe, healthy place in which to work. Nearly all manufacturing concerns have safety men, who are responsible for the removal of insanitary and unhealthy, as well as unsafe conditions. One hundred and eighteen of the establishments visited have in their employ whole or part-time physicians; twenty of these are connected with the safety work.

In considering the health and body hazards in industry, it is important to reduce elements of danger to a minimum, and so far as possible to consider the physical and temperamental limitations of employees. Industrial physicians can, through physical examinations, assist the employer in the equitable distribution of work. He protects the workers from communicable disease by making it understood that anyone who does not feel well, or on whom there is a breaking out, should report for a diagnosis. In many cases, employers are responsible for certain industrial diseases as well as injuries, and the industrial physician can assist the sick and injured employees to an early recovery.

The physician can illustrate medical and dental prophylaxis by practical demonstrations applied in the treatment of those trivial ailments for which people often do not seek professional advice. Physicians are also in a position to suggest menus that may be adopted by the restaurants and cafeterias often established for the men. In the matter of rest and recreation, it is for the physician to determine which employees show the greatest need of it, when and how long it should be, and, if it be exercise, what kind is most beneficial. Instruction in the prevention of sickness offers great opportunities for preventive medicine. It must be recognized that mental worries, as well as physical ailments, absorb the workman's attention. It is to the physician that the workers feel most free to confide their troubles; because of this feeling, doctors have opportunities of assisting men in difficulties of which the employer would know nothing.

There seem to be four classes of physicians in industries: those who have taken up industrial service as an expedient and for the sake of the money it pays them, those who are qualified and are making industrial medical service their life work, and those who are in the industries as a means of establishing themselves in surgery or general practice. In choosing physicians, it is necessary that employers exercise every care to select men who are thoroughly competent, not only in details and routine work, but also in administrative capacity.

CARE FOR BLIND SOLDIERS.

THE problems involved in the care of the blind, the courage which these men show, and the attitude which the public should adopt, are a few of the subjects commented upon in Volume VIII, No. 4, of the *American Journal of Care for Cripples*. Sir Arthur Pearson, in his article, "Victory Over Blindness," describes the resolute, determined, and cheerful men who have come under his care at St. Dunstan's in England. This institution for the care of the blinded soldiers is situated in the heart of London, yet is surrounded by sixteen acres of land, which open into six hundred and fifty acres of Regent's Park. There is room for workshops and classrooms, and for such opportunities as poultry farming. Approximately seven hundred men are now employed as a result of their training, and as many more are still receiving instruction at this institution.

In order to make it possible for the blinded men to recover their power of locomotion, the floors of St. Dunstan's are carpeted and covered with linoleum pathways running in every direction. On the grounds, pathways of wire and handrails are used as guides until the men regain their confidence. Men gifted with the power of description regularly visit St. Dunstan's, describe the surroundings, and teach the men to visualize. The word *afflicted* is never used, and the men are proud and happy in what they are achieving. The classrooms are equipped with about two hundred and fifty tables, at each of which sit a man who is learning and a woman who is teaching him. The men are taught the Braille system of reading and shorthand, typewriting, massage, basket-weaving, cobbling, and carpentry work. The blinded soldiers are also taught to play again. They learn to dance, play cards, debate, row, swim, and give concerts and entertainments.

In America, the blinded soldier is cared for by the Government at Evergreen, United States General Hospital No. 7. This institution has the double function of a hospital and training school, and is described by James Bordley, Lieutenant-Colonel, M. C., U. S. A. The hospital is situated in Baltimore, on a beautiful

estate loaned by Mrs. T. Harrison Garrett. The main house is used as a hospital and rest house, and its wards are bright and airy. Besides the original buildings, there have been constructed by the Army eleven large buildings which include barracks, shops, a school, and facilities for manual training, recreation, gymnastics, and swimming. The men are taught how to be blind, and to regard themselves, except for the loss of sight, as normal men for whom the observance of the usual conventions of life and association with normal people are necessary. It is recognized that the development of the proper mental attitude is essential to success, and this aspect of readjustment is considered, as well as vocational reëducation.

Eugene Brieux, in his article, "Educating the Public in the Interest of the Blinded Soldier," reminds us that in serving the blind, we must not make them suffer by offering them pity and charity where help and intelligent assistance are needed; we must give them no more protection than they need, and sufficient kindness to help the blind without making them aware of it.

MEDICAL NOTES.

The Red Cross and the Rural Community.—Plans for the development of the Home Service activities of the Red Cross have been outlined in a recent issue of *The Red Cross Bulletin*. Of the 3,700 Home Service Sections, 2,900 are in places having a population under 8,000. In promoting social welfare among urban communities it has been found that schemes which work out well in cities are not always adapted to country districts. The Bureau of Rural Organization has therefore been created in the Red Cross Department of Civilian Relief, of which Professor E. L. Morgan, of the faculty of the Massachusetts College of Agriculture, has been appointed director. Professor Morgan believes it to be of first importance that the people of a community be led to come together to study local problems with the help and education of various organizations, boards, and institutions. Red Cross workers will help as far as possible in formulating a definite program of work, and will also endeavor to assist the community in getting in touch with other sources of help. The rural community is looked upon as being only a part of a chain of development; some problems can be met only on the basis of a county or a state. In most counties, for instance, there may be found a number of county-wide organizations working with the various towns of the county. It is the purpose of the Red Cross to promote such development of the local community and the county as will bring about as rapidly as is feasible permanent development of rural affairs.

Influenza in Saskatchewan, Canada.—Preliminary mortality figures covering the epidemic period from September, 1918, to March, 1919, indicate the prevalence of influenza in the Province of Saskatchewan, Canada. A recent issue of the *Public Health Reports* states that a total number of 4,322 deaths were reported, a figure higher than Saskatchewan's loss in the war. The greatest number of deaths occurred between the ages of twenty and twenty-nine years. From the standpoint of occupation, it was observed that most deaths occurred among the farmers. Where influenza was the primary cause of death, there were 3,263 deaths, or 75 per cent. of the total number of deaths. Pneumonia was by far the most fatal complication. There were only fourteen towns in which no deaths were reported, and there was less influenza in the rural than in urban communities. Reported cases indicate that the greatest number of deaths occurred on the seventh and tenth days.

Bureau of Navigation.—The Bureau of Navigation has issued the announcement that commanding officers are authorized to transfer to the regular Navy to serve the unexpired portion of his enrollment any man, at his request, in the Naval Reserve Force, whether now on active or inactive duty, who is not more than forty-five years of age, who had performed active service during the war, and who will have not less than one year to serve in the regular Navy after such transfer. Reserves so transferred will receive the same pay, rights, privileges, and allowances in all respects as now provided by existing law for men regularly discharged and reënlisted within four months upon expiration or full four years enlistment.

National Tuberculosis Association.—The following facts about tuberculosis have been

collected by the National Tuberculosis Association. This disease alone annually causes 150,000 deaths in the United States. It is generally believed that infection takes place during childhood as a result of carelessness or ignorance of the nature of the disease and the methods of avoiding infection. The official records of the war department show that almost 100,000 men were rejected because they were suffering from tuberculosis. The disease has increased greatly in Europe during the war with the increasing shortage of food. Plans are now being formulated for carrying on a campaign during the months of October, November, and December, to culminate in a Red Cross Christmas Seal Sale of unusual proportions.

RESEARCH DEFENSE SOCIETY.—At the annual meeting of the Research Defense Society, held on June 26 at the house of the Medical Society of London, the progress which has been made in experimental medicine during the war was discussed. *The British Medical Journal* states that Sir Anthony Bowlby, K.C.B., in commenting upon experimental medicine and the sick and wounded in the war, expressed his belief that the British Army had been the healthiest of all the armies engaged and that its sick wastage had been less than that of other countries. He spoke of the value of prophylactic inoculation against enteric fever, and of antitetanic inoculation. The ratio of cases of tetanus in September, 1914, was six times as high as it became in November, and nine times as high as it became in December. Other investigations resulted in collecting valuable information about gas gangrene, and about the dissemination of trench fever through experiments on British and American volunteers. As a result of studying the problem of dysentery, both the amoebic and the bacillary form, it was found possible to prevent spread and to expedite cure.

APPOINTMENT OF DR. ADAMI.—Dr. J. G. Adami, who has been director of the Department of Pathology at McGill University, has been appointed vice-chancellor and principal of Liverpool University and will sail for England on August 20. Dr. Adami will be succeeded by Dr. H. Oertel, who received his degree of Doctor of Medicine from Yale University in 1894.

BOSTON AND MASSACHUSETTS.

BROOKS CUBICLE HOSPITAL.—The Brooks Cubicle Hospital is being erected on Summit Avenue, Brookline, adjoining the Brooks Hospital on Corey Hill, for the care of pneumonia patients. It is to be a temporary structure, to be completed in about a month, and will care for twenty patients. The building has two wings, each with five cubicles. Dr. Thomas M. Durell of Somerville is to be chief of the staff, and Miss Elizabeth Felton will have charge of the nurses.

WEEK'S DEATH RATE IN BOSTON.—During the week ending August 16, 1919, the number of deaths reported was 149 against 193 last year, with a rate of 9.75 against 12.83 last year. There were 31 deaths under one year of age, against 37 last year.

The number of cases of principal reportable diseases were: Diphtheria, 22; scarlet fever, 16; measles, 4; whooping cough, 14; typhoid fever, 4; tuberculosis, 44.

Included in the above were the following cases of non-residents: Diphtheria, 4; scarlet fever, 8; whooping cough, 1; tuberculosis, 5.

Total deaths from these diseases were: Diphtheria, 1; tuberculosis, 13.

This is the lowest week since July 16, 1904, when there were 142 deaths.

NEW ENGLAND NOTES.

NEW ENGLAND WAR RELIEF FUNDS.—The French Orphanage Fund has reached a total amount of $510,838.19, and the Italian Fund, $301,159.36.

Subscriptions to the amount of $180,562.66 have been acknowledged by the New England Branch of the American Fund for French Wounded for the American Memorial Hospital.

VITAL STATISTICS OF NEW HAMPSHIRE.—That the influenza epidemic had a marked effect on New Hampshire's population is shown by a statement recently issued by the secretary of the Board of Health. In 1918 there were 9612 deaths in New Hampshire, a number which is within 23 of the total number of births. In 1917, births exceeded deaths by 2103. The effect of the war on marriage is shown in the fact that there were but 3,793 marriages in 1918, fewer by 815 than the number in 1917.